

TECHNICAL MEMORANDUM

Utah Coal Regulatory Program

#3100

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March 31, 2009

TO: Internal File

THRU: Daron Haddock, Permit Supervisor *DH*

FROM: Priscilla Burton and Coal Hollow Review Team *PB by SCS*

SUBJECT: Alluvial Valley Floor Review – Coal Hollow Mine, Alton Coal Development, LLC, Kane County, C/025/005, Task ID #3100,

SUMMARY:

The Coal Hollow Review team members (Jim Smith, Dave Darby, Joe Helfrich, Wayne Western and Priscilla Burton) have had several technical discussions on the potential for an Alluvial Valley Floor within the Coal Hollow permit area. What follows is a compilation of the views expressed by all team members during these discussions.

After evaluation of the application contents with regard to R645-302-321, the Division finds that Sink Valley below Kane County Road 136 is a typical AVF, with a well defined, continuous channel, floodplain, and terraces, although the agricultural use at this location has not been demonstrated. The Division finds that there are certain characteristics of an AVF in Section 29, T. 39 S, R. 5 W (agricultural activity, subirrigation and water availability), but not the defining geomorphology (floodplain and terraces) ordinarily found in an AVF. The unusual hydrologic importance of subirrigation to agricultural activity along the eastern boundary of the proposed permit area indicates to the Division the importance of maintaining and protecting the function of the near surface groundwater flow in this area. While not affirming the Division's finding in 1988 that there is an AVF in Sink Valley in Sections 19, 20, 29, and 30, there are characteristics indicating a possible AVF in Section 29 between the Tropic Shale Ridge (Dwg. 6-9) and Swapp Hollow, and possibly extending southward to include all of Sink Valley in Section 32.

The 2008 Coal Hollow mine plan is also under review for alluvial valley floor character by a third party. There has been no final AVF determination made at this time.

The applicable R645-302 rules are used to organize the discussion below. The review team members have had an opportunity to review, comment and edit this assessment, prior to its inclusion in the Technical Analysis on March 30, 2009.

ALLUVIAL VALLEY FLOORS

Regulatory Reference: 30 CFR 785.19; 30 CFR 822; R645-302-320.

Analysis:

Alluvial Valley Floor Determination

The applicant has made a request for determination of alluvial valley floor for the proposed Coal Hollow Mine and Sink Valley Wash area.

Background Information

The Alton/Sink Valley area was the subject of a much larger, mine permit application in 1982 and 1987 by Utah International Inc. (UII, P/025/003). The UII application included the Sink Valley area in T 39 S, R. 5 W. and surrounding federal leases in T. 39 S., R. 6 W.; T. 40 S., R. 4 W.; T. 40 S., R. 4 ½ W; T. 40 S., R. 5 W; and T. 40 S., R. 6 W. The federal leasing required an Environmental Impact Statement (Development of Coal Resources in Southern Utah, 1979). The Office of Surface Mining (OSM) commissioned a reconnaissance report of the alluvial valley characteristics of the Alton Area in 1980. The resulting report, by Jack Schmidt was titled, "Reconnaissance Determination of Alluvial Valley Floor Status and Assessment of Selected Geomorphic Parameters in selected Stream Valleys of the Alton Petition Area and Adjoining Lands, Garfield and Kane Counties, Utah." The Schmidt report details agricultural production, water rights and water diversions in the Alton amphitheater and Johnson Canyon at the time. The report describes a very active agricultural community in Sink Valley and adjacent areas. (Jack Schmidt's full 1980 report can be found at 025/0005/2006/Incoming/0012.pdf.)

In 1983, OSM mapped the Sink Valley alluvial valley floor (AVF) and stressed the importance of agricultural land use in making the Sink Valley AVF determination, in the absence of more typical geology associated with an alluvial valley (OSM 1983 [draft] Alluvial Valley Floor Identification and Study Guidelines, Appendix D, pg. D-2 and D-6). OSM stated that the initial reconnaissance conducted of the Alton area by Jack Schmidt in 1980 was sufficient to confirm the existence of an alluvial valley floor based upon the importance of the valley land to agriculture (pg. D-4), but suggested that an Applicant for a mine permit might collect additional data to clarify the regional hydrologic pattern (page D-2).

OSM was required to make specific detailed findings with regard to the protection of the hydrologic balance and reclamation during the processing of the Alton mine permit application (which included tracts of federal leases) in response to petition and litigation in United States District Court for the District of Utah, Central Division (0250003/1987/Incoming/0040.pdf). The Court's Memorandum of Decision and Order was dated February 12, 1985.

The February 8, 1988 Initial Completeness Review for the 1987 UII Alton Mine application indicates on page 34 that the following areas were identified as probable alluvial valley floors (filed as 0025/0003/1988/Incoming/0023.pdf):

1. Upper Skutumpah Creek, Sec. 20 and 29, T40 S., R 4 1/2 W.
2. Skutumpah Creek, Sec. 30, T. 40 S., R. 4 1/2 W.
3. Thompson Creek and Tributaries, Sec. 30 and 19, T. 40 S, R 4 1/2 W and Sec. 24, 13, 12, T 40 S., R. 5 W.
4. Bald Knoll Hollow, Sec. 14, 15 and 16, T. 40 S. R. 5 W.

The Division further stated in the Initial Completeness Review on pages 35 that the following areas had been "positively" determined to be Alluvial Valley Floors:

1. Skutumpah Creek in Sec. 32, T.40.S., R.4 1/2 W. and Sec. 5 and 6 in T.41 S., R. 4 1/2 W.
2. Thompson Creek in Sec. 31, T.40 S., R.4 1/2 W. and Section 6 in T.41 S., R.4 1/2 W.
3. Upper Sink Valley Wash in Sec. 32, T. 39 S., R. 5 W. and Sections 5 and 8 in T. 40 S. R. 5 W.
4. Sink Valley in Sections 19, 20, 29, and 30, T. 39 S., R. 5 W.
5. Lower Swapp Hollow in Sec. 28, T. 39 S., R. 5 W.
6. Kanab Creek in Section 18, 24, 25, 26, and 36, T. 39 S., R. 5 W.
7. Alton Amphitheater in Sec. 6 and 7, T.39S., R.5W. and Sec. 1, 11, 12, and 13 in T.39S. R.6W.

The Coal Hollow proposed permit area encompasses the Sink Valley in Section 19, 20, 29 and 30 in T. 39 S., R. 5 W. The Division's 1988 decision was based upon borehole data showing sorted deposits of sand size or larger particles and previously published information, as laid out in a memo from Richard Smith, Geologist, to John Whitehead, Permit Supervisor, dated November 9, 1987 (025/0003/1987/Internal/0002.pdf).

The UII commissioned Water Engineering Technology, Inc. (WET) of Fort Collins, CO to evaluate the Sink Valley area. The 1988 WET report, titled "Geomorphological and Sedimentological Characteristics of Sink Valley, Kane County, Utah" argued that the sediment in Sink Valley is comprised of coarse material in an alluvial fan laid down by unconfined sheet floods, debris flows and mud flows. The report claims there was never a continuous stream in Sink Valley. Thus, by R645-100 definition, a lack of a continuous stream channel meant an alluvial valley floor in Sink Valley could not exist.

The Division was not persuaded by the WET report. To the contrary, Richard Smith, Division Geologist, viewed the WET report as further evidence of unconsolidated stream-laid deposits holding streams and reported as much to the Division Associate Director, Ken May, on October 13, 1988. His memo cited near surface deposits of sand

sized particles, selectively sorted, and deposited within and adjacent to stream channels, as well as the presence of smooth land surfaces and channels exceeding 3.0 ft. wide X 0.5 ft. deep within Sink Valley, and the established agricultural land use, for a positive determination of an alluvial valley floor in Sink Valley (0250003/1988/Internal/0001.pdf).

In December 1988, Nevada Electric Investment Company (NEICO, a partner in UII) petitioned the Board of Oil, Gas and Mining for review of the Division's AVF determination. At the present time, no record has been located of the outcome of that petition, and there is reason to believe the cause was never heard before the Board. NEICO's assertions that Sink Valley is not an AVF are, in brief, that Sink Valley does not contain a continuous stream, the unconsolidated alluvia do not have the characteristics of streamlaid deposits, and there is no floodplain – terrace complex because the processes need to form them did not and do not exist in Sink Valley: these are similar to the arguments made in the current application.

Current Coal Hollow Mine Application

The Division staff have reviewed the 2008 Coal Hollow Mine application for information pertaining to the existence of an Alluvial Valley Floor. The application is under review by a third party as well. There has been no final determination made at this time.

The 2008 Coal Hollow Mine application includes the WET 1988 investigation in Appendix 7-4; current reconnaissance by Peterson Hydrologic Inc. in Appendices 7-1; and. Alluvial Valley Floor Supplemental Information in Appendix 7-7 that specifically addressed land use, soils, vegetation and hydrologic questions raised by the Division during the 2007 Administrative Completeness review.

In the discussion below, the Division evaluates the application for information pertinent to R645-302-321, in order to make a determination of the extent of any alluvial valley floor within the proposed permit area, and adjacent area, per R645-302-321.300. The applicable R645 Rules are used to organize the discussion.

R645-302-321.210 Mapping of Unconsolidated Streamlaid Deposits Holding Streams

Appendices 7-1 and 7-4 refer to the definition of "alluvial valley floor" in the R645-100 Rules which exclude from an alluvial valley floor all "upland areas...composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff ...or other mass movement accumulations..." The term, "upland areas" is also defined in R645-100 and means, "those geomorphic features located outside the floodplain and terrace complex, such as isolated higher terraces, alluvial fans..."

The applicant states that no flood plains or stream laid deposits were identified in the project area, consequently a map of the flood plain and terraces was not created for Robinson Creek and Sink Valley Wash (App. 7-7, pp. 4-5). The Applicant found no evidence of flood plain and terrace features that are characteristic of alluvial valley floors (App. 7-7, pp. 4-5) and suggests that coalesced alluvial fans form the surface of Sink Hollow Wash (App. 7-7, pp. 2-3). This position is strongly supported by the information presented in Appendix 7-4, the WET Report.

The Applicant suggests the lack of continuous channel is indicative of an alluvial fan, due to deposition by mud flows, sheet floods, and debris flow, but also that the lack of a continuous channel may be partly due to human activity (construction of diversions, ponds). The Applicant refers to Plate 1 in App. 7-7 showing numerous discontinuous channels, but no continuous channel in Sink Valley Wash. The Division notes the discontinuous channels shown on Plate 1 seem to coincide with the historically developed pastureland shown on Dwg 3-1. If the ponds that have been constructed in the channel are taken into account, it is evident that Sink Valley Wash is a continuous channel from its origin in Section 21 Canyon and to the east of the Johnson Ranch; however, in the NW/4 of Section 32, the channel dissipates and the flow is spread across the surface as overland flow, which has been described by the Applicant.

[A deficiency has been written to request that the permit boundary should be shown on Plate 1 for ease of comparison with other (larger scale) plates.]

Neither the federal or R645 Rules use the term "continuous channel" to define alluvial valley floor. Drawing 7-3, indicates continuous point-to-point diversions along the length of the Sink Valley Wash channel and the USGS Alton Topographic Quad shows a continuous channel for Sink Valley Wash. Figure 19, App. 7-1, shows the tributaries to Sink Valley. The figure and several maps show a stream channel in Sink Valley. Sink Valley has the appearance of an alluvial valley floor, because it once contained a continuous stream channel, which deposited alluvial stream laden sediments. There are undoubtedly both colluvial and stream laid deposits Sink Valley from past geomorphic activity. After reviewing the information in the PAP and the WET report the Division concludes it's likely that both alluvial and colluvial systems operated to form large alluvial fans along the edge in Sink Valley. In the middle and below Swapp Hollow the streams running from the fan combine to form an alluvial channel down Sink Valley. The stream flows that enter the valley in the early spring is now captured and dispersed along the valley via ponds and diversions. Maps including Plate 2, shows the surface water drainage patterns, and Drawing 7-7 shows stream patterns. The aerial photograph of Plate 4 shows the surface features in Sink Valley, including the alluvial fan at the upper end of the valley. Most of the main channel has been covered in the past by farming activity, leaving a series of ponds that outline the channel. If the streamflow to the valley was significant the channel would most likely have been left intact. Some of the runoff from Water Canyon is diverted to Robinson Creek while the rest of the water including that from Section 21 Canyon infiltrates into the alluvial fan at the upper end of Sink Valley. It is believed that the finer alluvial that has built up in the middle of Sink Valley as it filled with sediment material retards the groundwater flow in the eastern and western sides of the valley.

On October 1 and 2, 2008, Division personnel examined the area for AVF characteristics. They determined that upper Sink Valley Wash, where the mine is proposed, consists of alluvial fan deposits, with no floodplain and terrace complex. There was no consensus as to whether or not there is a continuous channel, even when the impacts of human modifications are accounted for. Although some characteristics for an AVF are present (see definitions for both "Alluvial Valley Floor" and "Upland Areas" in R645-100-200, i.e., unconsolidated stream-laid deposits and agricultural activity supported by irrigation and subirrigation), not all characteristics listed in the definitions in the Coal Mining Rules are clearly present, i.e., stream-laid deposits holding streams with water availability sufficient for irrigation or subirrigation agricultural activities. There is water available for subirrigation and irrigation, but the "stream" through Sink Valley Wash is not the only source of the water. Subirrigation and agricultural activity also occurs on the edges of Sink Valley where groundwater flows through colluvial deposits from the adjacent hillsides. By definition these conditions do not constitute an AVF. The Applicant plans to mine in the vicinity of the springs and groundwater resource flowing through the colluvium. The Applicant has been directed to submit water rights data to identify any spring and well with state appropriated waters that may have to be replaced (see deficiency written under R645-301-720 in Environmental Resources/Hydrology).

The ground water supply from Robinson, Water, Section 21 Canons and Swapp Hollow recharge the springs in Sink Valley as well as the deep groundwater system and alluvial stream laid deposits. As mentioned the stream laid deposits are less porous and have less transmissivity than the colluvial deposits. From the WET Report it is interpreted that the stream laid deposits range along the eastern to middle part of Sink Valley beginning below Swapp Hollow to the lower canyon of Sink Valley. The sedimentary structure of Sink Valley Wash consists of colluvium and alluvial fans deposited by unconcentrated runoff, and there is no floodplain and terrace complex.

In Appendix 7-4, the application describes the origins of Sink Valley through the burial of Tropic Shale by Wasatch sediments brought down from adjacent canyons (Robinson, Dry Creek, Sec. 21 Canyon and Swapp Hollow) and the eventual lowering of Robinson Creek, which siphoned off a portion of the Sink Valley flow, creating a residual alluvial fan bordered by a Tropic Shale ridge. The shale ridge blocks subsurface flow of groundwater to the west, bringing the shallow groundwater system to the surface on the eastern boundary of the permit area as evidenced by numerous seeps and springs shown on Dwg. 7-1 (pp.7-3 and 7-4 Sec. 721, Chap. 7). These seeps and springs either sub-irrigate the lands within, east, and south of the permit area or they fill ponds for domestic, stockwatering, irrigation, or wildlife uses (Table 1, App. 7-1 & App. 7-3). This area is generally represented by groundwater discharge area A on Dwg. 7-4.

The Applicant describes a preferential pathway for alluvial groundwater flow through deep coarse-grained alluvial sediments along the east side of Sink Valley, outside the proposed permit area (Chap. 7, Section 721, 728 p. 7-26). This deep water was tapped at artesian wells Y-102, Y-61, Y-59, and C5 (Fig. 13, App. 7-7). The deeper

groundwater system is in communication with wells SS at the south end of the permit area, where data from SS wells provides evidence of a 15 foot thick, highly permeable strata located 60 to 75 feet below the surface (Chap 7, Sec. 727, p. 7-27 and App. 7-1, Table 8). The application states that this coarse stratum is in contact with the artesian groundwater system found in Section 29, east of the proposed permit boundary, and that groundwater recharge to the lower half of the Sink Valley sediments occurs via horizontal migration. Artesian wells were also noted to the south of the permit area in Section 32 (Chap 7, Sec. 721, p. 7-5). This area is generally represented by groundwater discharge area B on Dwg. 7-4.

The depth of the water bearing coarse strata in well SS (App. 7-1, Table 8) corresponds with the top of the coal elevation shown on Dwg. 6-5 at the SS well location(not on drawing 6-5). Thus, the coal seam that is 200 feet below the surface at the mouth of Swapp Hollow (App. 7-1, Table 5, Well 36) may be in contact with the artesian water in surrounding wells that are screened at depths 62 to 142 feet below the surface (App. 7-1, Table 5). Alternatively, the Tropic Shale (which forms a barrier to water movement in the northern part of the permit area) thins to the south of the permit area and becomes less of an impedance to water flow between the alluvium and the coal to the south of the permit area. The application indicates that flow through the deep, coarse fragments provides better quality, water emanating from SP 32, south of the permit area (Chap. 7, Section 721, p. 7-8). The same strata would likely be responsible for the flows into Sink Valley at SP4 and SP 27 at the contact with the Dakota formation (just below the coal seam).

A small amount of flow (5 – 10 gpm) emanates in the channel at the coal seam as a spring to Robinson Creek in the northwest end of the permit area (Chap 7, Sec. 721, p. 7-6). While the coal seam is reported to have low transmissivity at Y-38 and Y-36 locations (Chap 7, Sec. 721, p. 7-4), the SS-75 well had high transmissivity (Table 7-8). Clearly the groundwater contained in this coarse stratum does not provide flow at SW 6 or SW 9 in the lower Sink Valley stream channel. These stream monitoring locations flow in response to snowmelt and precipitation events (Chap. 7, Table 4). Whether this groundwater 'daylights' downstream in lower Sink Valley should be determined.

The direction of shallow groundwater flow is shown in Figure 21 of App. 7-1. Dwg. 7-13 shows local saturation levels in the alluvium of Sink Valley, but does not represent a potentiometric surface. Alluvial ground water is present in confined piezometers at a depths of two to twenty feet within the proposed permit area (Table 1, App. 7-7). Unconfined water is evidenced by the numerous springs shown on Dwg. 7-1. The Applicant concluded that the distance between the monitoring wells and the perched, discontinuous nature of the saturated zones did not allow extrapolation of the potentiometric data for the entire permit area (App. 7-7, Sec. 2.6). The Applicant also concluded that an isopach map of the depth to saturation, based on the soils pits and shallow exploration bore holes, was not possible, because a continuous, saturated, ground-water system was not found (App. 7-7, pp. 7- 8). The Division notes that Table 2, App. 7-7 indicates depth to ground water in soil pits was between one and six feet on

the eastern side of the permit area and between four and ten feet in the center of the permit area.

Figure 8, App. 7-1 illustrates the geology in cross-section. Figure 8, App. 7-7 shows the streams, ponds, springs, and well locations in relation to surface geology, as well as the projected location of the pits and permit boundary. The Applicant states that Kanab Creek and its tributaries are downcutting. Robinson Creek, the only continuous channel in the Sink Valley Wash area, is deeply incised and appears to be actively downcutting. The Division notes that Appendix D of the 1983 OSM AVF Guidelines acknowledges the entrenched stream courses (pg D-4) and states that the central question becomes, what valleys have the capability to be irrigated?" (pg D-8). The OSM AVF assessment assumes water can be "transported to any terrace level, providing that a part of that level had historically been irrigated." (pg. D-8). The more important issue is water availability (pg D-9).

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The information provided indicates that there is not the typical terrace and stream channel geomorphology or a defined continuous channel in Sink Valley. The application describes a locally important artesian water source that is stratigraphically above the coal seam.

R645-302-321.220 Mapping of Agricultural Lands

The application describes shallow groundwater sources that provide subirrigation east of the Sink Valley Fault within the permit area, for agricultural activity on C. Burton Pugh's and Richard L. and Alicia S. Dame's meadowlands shown on Dwg. 3-1, and immediately east of the permit area for Darlynn and Arlene Sorensen's meadowlands and pasture shown on Dwg. 3-1. In addition, Sorensen's diversion structures are in place and irrigation can be implemented in high water years immediately east of the permit area. Pugh's irrigation diversion structures are in place, but in disrepair within the permit area. Dame's irrigation structures are not shown. Johnson's irrigation ditches are not shown.

App 7-7, Sec. 4.1 through 4.3 provides a description of the agricultural use of lands within and adjacent to the permit area by cattle and for crop production. The locations of existing undeveloped rangeland, subirrigated lands, crop lands and pastures are shown on Drawing 3-1 and Drawing 7-7. There are 69 acres of meadow, 192 acres of pasture, 215 acres of sagebrush/grass land and 40 acres of oak brush, and 114 acres of

pinyon /juniper in the permit area (un-numbered Table, Sec. 321.100, Chap. 3, pg. 3-3). Dry meadow acreage is described in Section 311.100, but the acreage was not calculated. The Division estimates the dry meadow acreage to be twenty acres. Meadow, pasture and oak brush are by far the most productive lands with production estimated (not measured) at between 1,100 to 2,000 lbs/acre (Table 3-34 ,Sec. 321.100, Chap. 3).

Grazing lands supported by numerous seeps and springs dominate the proposed permit area as shown in Chap 4, Ex. 4.1. Acreage used for pasture was not provided for Pugh or Dames lands, although one can estimate based upon the information in Section 321.100 described above that there is 261 acres of meadow and pasture. Production estimates for the meadow are 1 Ton/acre. The value of supreme to premium dairy quality alfalfa hay would be on the order of \$130/Ton, based upon the Utah Department of Agriculture's February 27, 2009 (<http://ag.utah.gov/news/publications/reports.html>). Therefore, the value for the crop produced by 69 subirrigated meadow acres within the permit area would be \$8,970 annually. The unirrigated pasture land within the permit area has half the productivity would have a crop value of \$12,980 annually. Crop land east of the proposed permit area is illustrated on Ex. 4.1. Crop land is illustrated on Ex. 4.1 east of the proposed permit area. Acreage under production was not provided, and Ex. 4.1 has no scale, so that acreage cannot be calculated. Drawing 7-1 shows the total number of seeps and springs in the permit area available for grazing animals. Drawing 7-7 shows the ponds and ditches developed to support agriculture. Both Pugh and Dame own lands designated pastureland or subirrigated meadow lands within the permit area that have been leased to Alton Coal Development (Dwg. 3-1 and 7-7). These subirrigated lands are grazed to produce cattle, but are not cultivated to produce crops (Appendix 7-1, p. 48).

The number of cattle were not specified, although there may have been up to 750 in Pugh's herd at one time, based upon the water rights information provided in App. 7-3. Appendix 7-3 indicates that within and east of the permit area, within Sections 19, 20 and 30, Pugh holds three of eight water rights on stream reaches in Lower Robinson Creek with total allocations for 750 stock unit diversion limit. The BLM holds two additional water rights in Sec 19 and 20 that are allocated for stockwater for the Cecil Pugh grazing allotment No. 39, with a total of 26 stock unit diversion limit. Heatons have a water right just upstream of the BLM water right in Sec. 20, also for stock watering (1,600 stock unit diversion limit). Adjacent to the permit area, the BLM holds a water right in Sec 25 on Robinson Creek allocated for stockwater for Sharon Lamb grazing allotment No. 38, with a total of 18 stock units. The Lambs hold an additional water right in Sec 25 for stockwatering of 60 stock units.

Further upstream (east) from the permit area, Pugh and Sorensen also hold water rights on a reach of Right Hand Wash, in Sec 21, for 250 and 300 stock units, respectively.

Sorensen holds a water right on the stream in Sink Valley wash. Swapp and Lamb hold water rights on reaches of Kanab Creek for stockwatering, with a combined

460 stock diversion limit. The locations of these stream reach water rights are identified on Plate 7-3, Water Rights.

The Pugh lands were formerly quite productive: 700 bushels/acre of potatoes were raised with irrigation on the Pugh property in 1917 and in the 1950's oats and wheat crops were produced (personal communication with C. Burton Pugh, September 6, 2006).

East of the permit area, Darlynn Sorensen currently produces hay on 154 acres at the mouth of Swapp Hollow (Appendix 7-1, p. 48). Production from the Sorensen field varies by water year from 2,000 to 6,000 bales of hay (80 lbs each). This equates to 80 to 240 Tons of hay. The value of supreme to premium dairy quality alfalfa hay would be on the order of \$130/Ton, based upon the Utah Department of Agriculture's February 27, 2009 (<http://ag.utah.gov/news/publications/reports.html>). At \$130/Ton, the Sorensen's annual crop value would therefore be between \$10,400 and \$31,200.

The information provided indicates that subirrigated meadow currently supports limited agricultural activity within the permit area. Meadow and croplands east of the permit area supports a larger agricultural operation.

Acreage of crop production shown on Ex. 4.1 in the adjacent area should be provided as well as mapped, along with acreage figures and mapping of the adjacent areas under production along Kanab Creek and lower Sink valley.

R645-302-321.230 Mapping of Current or Historic Flood Irrigated Lands

The Division notes that Appendix D of the 1983 OSM AVF Guidelines acknowledges the topography does not fit the typical flood plain and terrace system, but that the topography is suitable for irrigation. The topography has a gentle slope of 1 – 5% in Soil Map Unit 7 and 3 – 8% in Map Units 1 and 4 (Section 222.300 and Dwg. 2-1). The Sorensen's hold three surface diversion rights in Right Hand Wash to irrigate 104.6 acres in the W ½ of Sections 29 and 32. Sorensens hold one water right for surface diversion on Swapp Canyon Creek and four water rights for surface diversions on Sink Valley Wash for irrigation of a combined 42.4 acres in the W ½ of Sections 29 and 32. In total the Sorensens hold water rights for the irrigation of approximately 143 acres in the W ½ of Sections 29 and 32 and stockwater for 300 units.

Johnson has one surface water right on Sink Valley Wash for the irrigation of 9.0 acres and stockwater for 125 stock units.

The application acknowledges the land is suitable for flood irrigation and that lands have been historically irrigated but that water availability limits the potential for irrigation (Chap. 7, Sec. 728, p. 7-3). Irrigation has not occurred within the proposed permit area for the last 10 years (p. 48, App. 7-1), but a defunct system of water distribution does exist for the Pugh property. The Dame property is subirrigated and apparently needs no supplemental irrigation. Table 2, App. 7-7 indicates depth to groundwater in soil pits was between one and six feet on the eastern side of the permit

area and between four and ten feet in the center of the permit area, allowing for sub-irrigation of meadows and pastures. East of the permit area, the flow from Swapp Hollow provides an average discharge of 55 gpm or an annual yield of 88.7 acre-feet (App. 7-7, Sec. 6.1.1). Flow from Swapp Hollow is retained in pond 29-1 (Dwg. 7-7).

Drawing 7-7 identifies flood irrigated and subirrigated lands, ditches that have been used for irrigation, and ponds that were probably part of irrigation systems. The Applicant states in Section 728.334, that there has been no irrigation during the past 10 years. The reason given for the decline in agricultural activity is the lack of appreciable quantities of water (App 7-7, pg. 13). Water monitoring conducted between 2005 and 2007 shows no appreciable difference from the 1987-88 data. Although, the Palmer Hydrologic Index (Figure 2, App. 7-1) does indicate that there were several years of drought in the past decade that would have limited irrigation, the Division concludes that the decline in irrigation in the SW $\frac{1}{4}$ Sec 20 and the SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec 19 has less to do with water availability and more to do with the landowner's disinclination. During a site visit in October 2008 the Division noted pipes on Pugh lands were corroded and cracked at the collection point and disconnected along their length from holding pond 20-1. In addition, source waters from Water Canyon on USFS lands had left the stream channel and were lost in overland flow before reaching the collection point. Despite a lack of irrigation, the Division noted 35 cattle grazing subirrigated Pugh lands on October 1, 2008.

Appendix 7-7 describes the general construction and use of the water holding ponds. There are few conveyance systems between ponds; all conveyance systems in the area are indicated on Drawing 7-7. The conveyance systems consist of earthen ditches.

Stockwatering is the use stated on most of the water right printouts in Appendix 7-3, but most spring and surface-diversion rights in the W/2 of Sec. 29, E/2 of Sec 30, and W/2 of Sec. 32, T. 39 S., R. 5 W., along Sink Valley Wash around and downstream of the Swapp Ranch, either cover both stockwatering and irrigation or are for irrigation only. Ponds are used for stockwatering and irrigation systems (App. 7-7, pg. 14).

Within the proposed permit area there is one spring with a domestic water right, SP-7 (Pugh, water right 85-215), located right along the fence between Pugh's and Dame's properties (Dwg. 7-3). Adjacent to the permit area, there are two springs with a domestic water right: SP-3 (Sorensen, water right 85-373), and SP-10B (Johnson, water right 85-1011). These springs are also identified as SP-35, SP-40, and SP-33 on Dwg 7-1, as noted in deficiency R645-301-722.300 under Environmental Resources/Hydrologic Information.

Meadowlands shown on Dwg 3-1 are dominated by sedges, rushes and wild iris are subirrigated and the depth to alluvial groundwater is within "inches to a few feet below the ground surface" (App. 7-7, pg. 10). Depths to ground water in the pasturelands varies seasonally from within one or two feet to several feet below the surface (App. 7-7, pg. 12 and Table 1).

The Pugh lands were formerly irrigated using ditches, ponds, and pipes to bring water from as far as upper Robinson Creek (discussion with C. Burton Pugh in September 2005). Today, pasture lands in the permit area, dominated by introduced grass species, rely on precipitation and stored soil moisture for growth (average approximately 16 in/yr) and not on irrigation or subirrigation (App. 7-7, pg. 12). The Division notes that Dame's pasturelands may be subirrigated by the active water rights on Pond 29-3 and 29-5 (Dwg. 7-7).

Dwg 7-7 shows some flood irrigated fields owned by Sorensen. The flood irrigated and subirrigated designations are difficult to see on this drawing, since the legend for these lands is separate from the drawing legend, see deficiency under R645-301-121.200 below. Irrigation structures are shown on Dwg. 7-7. Darlynn Sorensen currently uses flood irrigation for hay or grain production on his property at the south end of Sink Hollow Wash (Dwg. 7-7). Irrigation typically was a single flood application in the spring, when adequate water was available (App. 7-7, pg. 13). During a site visit in the fall of 2008, the Division noted that Sorensen's pond 29-1 was receiving a steady flow through the Swapp Hollow ditch and that Swapp Creek was dry as a result. The water depth in Pond 29-1 was 6 – 8 inches. In the fall of 2008 Sorensen had cultivated the slopes around Pond 29-1, increasing the acreage of cultivated land in Swapp Hollow from that currently shown on Figure 4-1. (Figure 4-1 outlines croplands; Drawing 7-7 is titled Ponds, Ditches, Subirrigated and Flood Irrigated Lands, it outlines the flood irrigated lands in red, but doesn't outline cultivated acreage.)

The Applicant has shown that the agricultural use of the land within the permit area has declined on Pugh lands. Pond 20-1 was formerly used to irrigate pasturelands in the SW ¼ Sec 20 with water diverted from Water Canyon (several miles upstream). The applicant has shown that Pugh's subirrigated meadows in NW ¼ Sec 29 and Dame's subirrigated meadows in the W ½ Sec. 29 currently support grazing.

Adjacent to the permit area, Sorensen has an active agricultural operation with lands that are subirrigated and irrigated. There are 154 acres of Sorensen's irrigated lands east of the permit area (App. 7-1, p. 48). The Applicant states that irrigation is variable depending on water availability.

West of the permit area, lands are irrigated with water taken from Kanab Creek and lower Robinson Creek (Plate 5, App. 7-7; Water Rights App. 7-3).

There is no information on agricultural activity on the Johnson owned lands that straddle Sink Valley wash, just south of the permit boundary, see deficiency under R645-301-121.200 below.

R645-302-321.240 Documentation of SubIrrigation

There are 260 acres of meadowland and pastureland within the proposed 653 acre permit area (table on p. 3.3, Chap. 3 and Dwg. 3-1). Dwg. 3-1 outlines 69 acres of meadowlands within the permit area that are dominated by sedges, rushes and wild iris and are subirrigated: the depth to alluvial groundwater is within "inches to a few feet

below the ground surface" (App. 7-7, p. 10). Small acreages of meadow are located west of County Road 136 in Section 30. There are 192 acres of pasturelands within the permit area, where depth to groundwater varies seasonally from within one or two feet to several feet below the surface (App. 7-7, p. 12 and Table 1).

The locations of subirrigated lands are shown in Drawing 7-7 and described in App. 7-7, Sec 4.1. Drawing 3-1 shows meadow communities that are sub-irrigated. App. 7-7, Sec. 5.4.2 describes the meadow communities. These communities are all on the east side of the proposed permit area and they are all fed by numerous springs shown on Dwg. 7-1.

Soils in Map Unit 7 are wet. These soils are mapped on Dwg. 2-1 and their location correlates with the subirrigated lands shown on Dwg. 7-7. The July 15, 2007 infrared, aerial photo shows the moisture in Soil Map Unit #7 as red areas (Plate 4, App. 7-7). Map Units 6 and 13 have localized areas of subirrigation, including the approximately 20 acres of dry meadows shown in Plate 3-1 on the west side of County Road 136. The Applicant states that the representation of subirrigated lands on Dwg. 7-7 does not include these dry meadows that may also be subirrigated (pp. 10 and 12, App. 7-7). Depth to ground water within these meadows and pastures is provided in App. 7-7, Section 3.4, p. 10. The Applicant points out in App. 7-7, Sec. 2.6 that potentiometric data from piezometers (Table 1) does not represent shallow ground water conditions which are logged in Table 2 for the many soil pit locations shown on Figure 5 of App. 7-7. Together, Table 2 and figure 5 report that depth to water is between 50 and 120 inches in Sections 19 and 20 (T39 S, R5 W) and between 14 and 30 inches below the surface in Section 29 at the mouth of Swapp Hollow and between 60 and 80 inches in the E ½ S 1/4 of Section 30 on the southern most portion of the permit area. Depth to groundwater becomes very shallow again as one approaches Johnson Spring (shown on Dwg 7-2).

Soil mottling confirms subirrigation in plant communities (App. 7-7, Figure 10). The meadow and dry meadow plant communities grow where soils are sub-irrigated. App. 7-7 Section 5.4.4 refers to table 7 that identifies the characteristics of the meadow and dry meadow plant communities. App. 7-7 Section 6.4 states that "the topographic characteristics of most lands within the project area are compatible with flood irrigation techniques," and pasture land in the proposed permit area has the potential for subirrigation. In fact, Figure 10, App. 7-7 indicates that fine roots in all plant communities extend between 50 and 80 inches below the surface (with the exception of the very shallow pinyon/juniper community). The deepest rooted community is the Oak Brush at 80 inches. The shallowest rooted is the meadow community at 50 inches. The shallow rooting depth likely correlates to the availability of water.

Ten springs, with a combined total flow of approximately 23 gpm are allocated through water rights as follows from App. 7-3:

Pugh holds water right 85-214 on Tater Patch Spring (SP 1) in NW ¼ NW ¼ Sec 19, flowing at 0.33 cfs for irrigation of 0.6 acres and water for 250 stock units. Pugh

also holds water right 85-215 on Spring House Spring (SP-7), flowing at 0.007 cfs for domestic use and stockwatering of 250 stock units.

Dame holds four water rights on springs for irrigation of 93 acres in the NW, NE, SW, and SE quarters of Sec. 29 and water for 125 stock units [Swapp Ranch Spring No. 1 (SP 2; water right 85-350), flowing at 1 cfs; Swapp Ranch Spring No. 2 (SP 5; water right 85-351), flowing at 0.25 cfs; Swapp Ranch Spring No. 3 (SP-6; water right 85-352), flowing at 0.25 cfs; and Swapp Ranch Spring Area No. 4 (SP 8; water right 85-353), flowing at 1.0 cfs].

Sorensen has water right 85-373 on the Sorensen Ranch Spring No. 1 (SP 3), in the NE $\frac{1}{4}$ NW $\frac{1}{4}$ of Sec. 29, flowing at 0.011 cfs for use as domestic water and sole supply for stock watering for 300 stock units; water right 85-374 on the Sorensen Ranch Spring No. 2 (SP-4), in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Sec. 29, flowing at 0.011 cfs, stock watering; and water right 85-375 on Sorensen Ranch Spring No. 3 (SP 9), in the NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 32, flowing at 0.022 cfs for stockwatering.

Johnson has water right 85-355 on Pulsifer Spring (SP 10A and SP10B) in the SW $\frac{1}{4}$ NW $\frac{1}{4}$ and the NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 32, flowing at 31.725 acre/ft/yr for irrigation of 4.82 and 125 stock units; and a segregated 0.9 ac/ft/yr for domestic use flowing from the same spring (SP10B).

The information provided indicates a substantial area of subirrigated meadow and potentially irrigated pastureland east of the Tropic Shale Ridge (in the proposed permit area and eastward) and to the south of the permit area on Sorensen land.

R645-301-321-250 Documentation Of Water Quality and Yield, Stream Flow, Soil Characteristics, and Topography Affecting Flood Irrigation Potential

Locations of springs and seeps identified in the Coal Hollow Project spring and seep survey are listed in Table 1 of sub-Appendix B of Appendix 7-1. Table 1 lists 33 seeps and springs, 28 of which flow from the alluvium. Drawing 7-1 and Plate 1 of sub-Appendix B of Appendix 7-1 show the springs and seeps in or immediately adjacent to the proposed permit area: 10 are within or on the proposed permit boundary. Table 3 and Figure 9 of Appendix 7-7 provide the water quality information of springs SP6 and SP8 (locations on Figure 8 of Appendix 7-7), which respectively represent the south and north subirrigated lands shown on Dwg 7-7. App 7-7 Section 5.2 compares water quality with Figure B-5 in the OSM, 1983 Alluvial Valley Floor Identification and Study Guidelines for irrigation water suitability. The spring water that is subirrigating lands in the permit area is Class 2 (medium salinity hazard, but not sodic) in the northern permit area, but degrades to Class 3 (high salinity hazard, not sodic) in the southern permit area. Stiff Diagrams on Figure 14 App. 7-1 (Peterson Report, June 12, 2007) show this change in water quality. The Division noted that water quality in the southern permit area has improved considerably between 1987-88 sampling and 2005 sampling, perhaps due to less grazing pressure or less agricultural activity?

Table 9 in App. 7-7 provides discharge and water quality data for selected surface water monitoring locations that are shown on Dwg. 7-2: Section 21 Canyon drainage (SW 7); Upper reach of Swapp Hollow (SW 8); Left Fork of Sink Valley (SW 6); (left) Dry Fork of Robinson Creek (SW 4); Lower Robinson Creek near the confluence with Kanab Creek (SW 5); Robinson Creek at the location where it is to be re-routed within the proposed permit area (SW 101); and Water Canyon (RID-1) . The Division notes that Sink Valley is monitored at SW 6, in a location that does not receive flow from the eastern canyons. The Division previously requested that Drawing 7-7 of irrigation structures be drawn on the same scale as Dwg. 7-2, so that the point of diversion on Robinson Creek could be known in relation to the monitoring point SW 4; and so that the monitoring point for Water Canyon (RID-1) can be seen in relation to the Water Canyon diversion to the Pugh pasture, see deficiency written under R645-301-121.200.

Swapp Hollow water is medium salinity, with low sodium hazard, suitable for most plants. Swapp Hollow Creek has the best potential to support flood irrigation. The Applicant states that the average instantaneous discharge measured for Swapp Hollow Creek is 55 gpm. Calculated annual yield is 88.7 acre-feet, which would irrigate approximately 24 acres of alfalfa or 33 acres of pastureland using an earthen ditch distribution system (App. 7-7, Sec. 6.1.1 and Table 9).

Lower Robinson Creek, Dry Canyon, Section 21 drainage, Upper Water Canyon spring diversion, Sink Valley Wash, and alluvial ground water discharges have less potential to support flood irrigation. The Applicant states the flow volumes are low and inconsistent. Water Canyon spring has good quality water. Water quality of the other potential sources is not discussed, mainly because analyses are sparse due to no-flow conditions.

Pond 29-3 on Richard Dame's property is fed by groundwater from an alluvial spring. Surface water collects downstream in pond 29-5, also on the Dame property (pg. 14, Sec. 4.2, App. 7-7).

The Sorenson's flood irrigated croplands are outlined on Dwg 7-7. The Sorenson property is just east of the permit area (Dwg 1-3). App. 7-7 Sec. 4.1 relates that ponds 29-1 and 29-2, as well as the ponds 29-6, 29-4, 29-7, 29-8, 29-9 [that function as a series of overflow ponds down the Sink Valley drainage] and pond 32-1 are all on Sorenson property. Of the Sorenson's ponds, only pond 29-7 is equipped with an outlet control structure for irrigation.

A portion of the Pugh property is subirrigated, the rest was flood irrigated with a diversion Water Canyon (Dwg 7-7). Pond 20-1 is located on the Pugh property and it is equipped with an outlet control structure for irrigation (Sec. 4-2, App. 7-7). There was no water in the pond in the fall of 2008 and the supply pipe was disconnected.

The information provided indicates that the terrain is suitable for irrigation, but that irrigation is not required to produce meadowlands and pasture. When available, irrigation doubles yield. Water quality data indicate that there may be enough water to flood irrigate; that the quality of water from shallow alluvial groundwater is sufficient to raise alfalfa or other grasses for hay crops and pasture. Groundwater from the deeper portions of Sink Valley to the east in Section 32 are part of a larger, more continuous groundwater system" that is of better quality than the shallow groundwater (p. 7-8 Chapter 7.)

The volume of water to be encountered during mining is related in Chapter 7, Section 727, p. 7-21. The Applicant states that the average discharge from all springs in Groundwater Area A (shown on Dwg. 7-4) sums to 35 gpm. The average discharge from all springs in Groundwater Area B sums to 17 gpm. If mining causes material damage to all springs, 52 gpm replacement water would be required.

The application states that there could be as much as 200 gpm entering the open pit at the south end of the permit area in the vicinity of well SS (App. 7-7, p. 35 and Chap 7, Table 8). (This is the same area where the applicant has requested a variance from the six month/1,500 linear feet backfilling requirement of R645-301-553.)

R645-302-321-260 Analysis of Aerial Photography Showing Seasonal Difference between Valley and Upland Vegetation.

Appendices 7-7 provides two aerial photographs of the valley floor. Plate 3 provides infrared imagery that was flown in July 15, 2006. Plate 4 provides imagery that was flown November 2, 2007. The applicant has labeled areas of wet meadow and wet pasture, and this vegetation type was described in the application. No acreages were provided. Although the imagery was referenced in the Application, there was no discussion or explanation of the infrared imagery to specify what conclusions were drawn from the comparison of the two photographs.

During the site visit on October 2, 2008, Dr. Patrick Collins and Joe Helfrich discussed the requirements of R645-302-321.260 and concluded that "an analysis of a series of aerial photographs including infrared imagery flown at a time of year to show any summer and fall differences between upland and valley floor vegetation" had been completed by the applicant (personal conversation with Dr. Collins, 10/2/2008). Although it was not specifically stated during the discussion in the field, the Division came away with the understanding that the results and conclusions of the analysis were readily available in the application and therefore the information in the application partially met the requirements of this section of the regulations. However, a discussion of the results and specific conclusions from the comparative analysis of the color infrared aerial imagery, Plates 3 and 4 still needs to be included in section 7.1 page 31 of Appendix 7-7.

Information on the ground water found in the geotechnical boreholes (Appendix 5-1) has been included in the discussion of ground water and seasonal variation in App. 7-7 (p. 7). Figure 6a and associated cross-sections provide a schematic representation of the thickness of the alluvium, stratigraphy, and depth to ground water at monitoring locations. Seasonal variation in alluvial water levels is portrayed in hydrographs in Figure 3 and on Table 1 of App. 7-7. Variation of the depth to groundwater and aquic conditions in the alluvial sediments, as observed in the soils pits, is provided in Table 2 and Figure 5 of App. 7-7. The information on groundwater depths is summarized in Figures 13 and 14 of App. 7-7.

On the average, depth to groundwater in wells east and south of the permit area is 4.5 feet and within the permit area it is 9 feet (Fig. 13, App. 7-7). Immediately east of the permit area, the head in artesian wells rises an average of 15 ft. above ground. Minimal seasonal variation in wells within the permit area and in the artesian flow is presented in Fig. 14, App. 7-7. Groundwater wells east and south of the permit area have a seasonal variation of four feet on the average. Seasonal variation in alluvial water levels was not related to vegetation changes (App. 7-7, p. 8), but was reported to be just below the surface at the beginning of the growing season, falling to a couple feet below the surface at the end of the growing season (App. 7-7, pg. 10). Seasonal variability of springs outside of the permit area was referenced on p. 11, App. 7-7. The applicant noted no specific correlation between seasonal variations of water levels and vegetation changes.

Adjacent Area

The Division is required to protect adjacent areas designated as alluvial valley floors, as per R645-302-320 and R645-302-322. Adjacent area is a defined term and means the area outside of the permit area where a resource or resources are or reasonably could be expected to be adversely impacted by the proposed coal mining and reclamation. As applied to an AVF determination, the adjacent area should include areas where there are characteristics used to evaluate the AVF and particularly areas where the hydrology regime may be affected by the mining and consequently may affect an AVF.

Adjacent alluvial valley floor areas are shown on Figure 3 of Appendix D of the 1983 OSM Alluvial Valley Floor Determination Guideline.

The Applicant mapped the existence of probable alluvial valley floors along Kanab Creek and lower Sink valley (Plate 5, App. 7-7). The probable Kanab AVF was supported by the existence of irrigation structures, ponds and agricultural cattle production. The probable Lower Sink Valley Wash AVF designation is downstream of the historic location of flood irrigated or subirrigated areas in Swapp Hollow and Sink Valley and was designated based upon the existence of a defined stream channel.

App. 7-7, Sec. 8.0 discusses the designation of probable adjacent alluvial valley floor areas along Kanab Creek and lower Sink valley based upon visual observations and the location of irrigation diversions and pond structures. The extent of these probable alluvial valley floors has not been documented for either the Kanab or Sink Valley

probable alluvial valley floors, however. Neither has an assessment of water quality or quantity been determined for the Kanab Creek probable AVF (in accordance with R645-302-322.100 and R645-302-322.200).

The December 18, 2008 application includes an outline of the adjacent area to show areas where hydrology regime may be affected by the mining. As drawn, the adjacent area includes Lower Robinson Creek, Sink Valley and the mouth of Swapp Hollow. As applied to the AVF determination, the adjacent area map shows areas where the hydrologic impact may affect the downstream probable alluvial valley floors shown on Plate 5, App. 7-7 (Kanab Creek and lower Sink Valley).

Agricultural production in a segment of the probable Kanab Creek alluvial valley floor was described in Section 8.0 of App. 7-7 as 200 acres of pasture or hay that yields approximately 1 Tons/acre. The value of supreme to premium dairy quality alfalfa hay would be on the order of \$130/Ton, based upon the Utah Department of Agriculture's February 27, 2009 (<http://ag.utah.gov/news/publications/reports.html>). The total annual value of the Lamb hay crop would be approximately \$26,000.00. This figure does not include the \$13,000.00 value of the after-crop grazing (estimated on p. 33 of App. 7-7 to be ½ Ton/acre)

Plate 5 illustrates less than the first mile of the probable Lower Sink Valley alluvial valley floor. There is no agricultural use in the first three-quarter mile of the probable alluvial valley floor in Lower Sink Valley Wash as shown on Plate 5 and discussed in Section 8.0. However the application does not discuss downstream agricultural activity and the map does not extend for the length of the continuous stream channel in Lower Sink Valley. The Bald Knoll, Utah, USGS 7.5 minute topographic map shows the Lower Sink Valley stream channel continuing south five miles to the confluence with Kanab Creek. Sink Valley receives tributary waters approximately every mile along its way to the confluence with Kanab Creek.

Findings:

In accordance with R645-302-321.300, the Division must make a finding of the extent of any alluvial valley floors within the study area (permit and adjacent area). The Division has reviewed the Alluvial Valley Floor information presented in the 2008 Coal Hollow Mine application and conclusions from this review are summarized below. The Alluvial Valley Floor determination is under review by a third party as well. There has been no final determination made at this time.

The Upper Sink Valley Wash, where the mine is proposed, consists of alluvial fan deposits, with no floodplain and terrace complex. Although some characteristics for an AVF are present, not all characteristics listed in the definitions in the Coal Mining Rules are clearly present, (see definitions for both "Alluvial Valley Floor" and "Upland Areas" in R645-100-200, i.e., unconsolidated stream-laid deposits and agricultural activity supported by irrigation and subirrigation). There is water available for subirrigation and

irrigation, but the "stream" through Sink Valley Wash is not the sole source of the water. Subirrigation and agricultural activity also occurs on the edges of Sink Valley where groundwater flows through coalluvial deposits from the adjacent hillsides. By definition these conditions do not constitute an AVF.

The Applicant plans to mine in the vicinity of the springs and groundwater resource flowing through the coalluvium. The stream laid deposits in Sink Valley will not be mined, however some of the ground water comes from the coalluvial sediments. Any interruption of the coalluvial sediments might lessen flow to the alluvial sediments, however the amount of this flow is unknown. During the field visit in October, by DOGM personnel, the flow could be seen as very small trickles into the ponds in the channel. Recharge to the alluvial sediments could also come from the deeper ground water and alluvial fans in Swapp Hollow. There appears to be no springs in the alluvial sediments, however there are surface water rights along Sink Valley (Drawing 7-3). The Applicant has already established a water monitoring plan for the streams and has committed to replacing any water rights that are interrupted (see also deficiency written under R645-301-720 in the Environmental Resources/Hydrology section of this Technical Analysis). Water monitoring site SW-8 is on Swapp Hollow creek and SW-9 is located at the lower end of Sink Valley.

As mining progresses to the east, a Tropic Shale ridge will be encountered. The ridge is a mass of consolidated, non-permeable rock forming the west limb of the Sink Valley trough. As mining encounters and removes the limb, it will come in contact with the coalluvial sediments that transport ground water to the springs. Many of the springs, which receive their supply of groundwater through the alluvial system are likely to be impacted, because the supply will be severed. The supply can be reestablished after the coal is extracted if the mine pits are reconstructed properly, so that the fill that once formed the limb of the trough is reformed and tightly compacted. The spring flow can be reestablished if coalluvial sediments are backfilled. Springs may not reestablish in exactly the same place, but the supply source coming from the northeast will continue to deliver flows to the area.

The Applicant has addressed some issues stating that mining will take place in pits that will be open no more than 120 days (Sections 724.500 and 728.310, p. 7-31). The Applicant stated that if substantial ground water flowed into the mine a study would be conducted to mitigate the flow. The Applicant was directed to show cross-sections how the mine would intercept the Sink Valley trough. Only one cross-section was submitted. The Applicant will have to provide specific information on cross-sections at least every 1000 foot intervals. The Applicant should show exact elevation where the mine will contact the Sink Valley trough and calculate the amount of flow expected while the pit is open. A north-south cross-section showing the gradient of the trough should be provided to show how flow migrating from north to south might be affected.

The Division requests the following information prior to making a final determination on alluvial valley floors, in accordance with:

R645-301-121.200, The plan states in Chap 7, p. 7-2, last paragraph, that there are no domestic supply wells within the permit area, however this information is contradicted by the last paragraph on page 8 of App. 7-1 which states that SP-35 is used seasonally for domestic use. SP-35 is shown on Dwg 7-1 within the permit area. Please make the appropriate correction to the narrative, plate or appendix. • Please provide information on well C5 in Table 8, App. 7-1. • Instructions included with the application dated 12/18/2008 indicated that Table 7-7 was to be replaced with a new Table 7-7. However, Table 7-7 was replaced by Tables 7-7A and 7-7B on January 24, 2008. Please either re-name Table 7-7 to replace an existing table or specify the existing Table that is to be replaced by Table 7-7. • References made on p. 7-4 to cross section Y-Y' in Dwg. 6-9 and elsewhere in the application appear to be incorrect. There is a cross section X-X' on Dwg. 6-9 dated 12/24/2008, however information received on December 12, 2008 replaced Dwg. 6-9 with a new drawing that does not include a cross-section. Please verify the reference and make the appropriate corrections to the application. • The permit boundary should be shown on Plate 1 for ease of comparison with other (larger scale) plates (repeated request from Task 2910). • Crop land east of the proposed permit area is illustrated on Ex. 4.1. Acreage under production was not provided, and Ex. 4.1 has no scale, so that acreage can not be calculated. Please provide a scale on Ex. 4.1 and indicate the acreage under production for Johnson, Sorensen, Dame and Pugh lands (similar to request from Task 2910). • Dwg. 7-7 was field checked in September 2007 and several modifications should have been made to reflect the increased area under cultivation owned by Sorensen, to clarify the pond structures 29-6 through 29-9 are semi-circle dams, to place the Dame fenceline adjacent to the road, etc. • Dwg. 7-7 of irrigation structures should be drawn on the same scale as Dwg. 7-2, so that the point of diversion on Robinson Creek could be known in relation to the monitoring point SW 4; and so that the monitoring point for Water Canyon (RID-1) can be seen in relation to the Water Canyon diversion to the Pugh pasture. These relationships must be shown to confirm that monitoring accurately portrays the water supply. (repeated request from Task 2910). • Dwg. 7-7 should indicate the location of Dames irrigation structures for 93 irrigated acres and Johnson's irrigation structures for 4.82 acres. • The survey of subirrigated lands shown on Dwg. 7-7 should be extended to include all of Section 32. • The map legend for Dwg 7-7 should include the key for irrigated and subirrigated areas etc., rather than having those markings listed separately from the map legend • Make Dwg. 7-3, Water Rights, more informative by identifying the water right associated with each colored stream reach. [PB]

R645-302-320, This Divisions finds the appearance of stream laid deposits in the center of Sink Valley. The applicant will have to show that the proposed operations will not interrupt discontinue or preclude farming on an alluvial valley floor, and that the groundwater system in Sink Valley can be restored. The Applicant was directed to show cross-sections on 1000 ft. intervals as to how the mine would intercept the Sink Valley trough, see deficiency R645-301-624, -724 and deficiency R645-301-728.300 in the Environmental Resource/Hydrology section of this Technical Analysis. [DWD]

R645-302-321.100, The Applicant should provide an indication of where the deep aquifer water intercepted by well SS-75 daylights downstream in lower Sink Valley. [PB]

R645-301-321.220 and R645-301-321.200, Appendix 7-7 and Chapter 3 provides the consultant's estimates of land productivity. Average yield data reported for high levels of management must also be provided in the environmental analysis. Current data may be available from the USDA or an appropriate state natural resource or agricultural agency. [PB]

R645-302-321.260, Section 6.4 states that "the topographic characteristics of most lands within the project area are compatible with flood irrigation techniques". Available water rights and historical irrigation indicate flood irrigation is important to agricultural use. The application needs to include a mitigation plan for restoring water to these areas. [JH] • Plates 3 and 4 include color infrared aerial imagery taken in July of 2006 and November of 2007. Moist areas in Plate 3 appear to be grey and moist areas in Plate 4 appear to be red. To enable a comparison between plates, the presentation of these two plates should be equivalent (developed with the same exposure time), such that moist areas are the same color on both plates. [PB] • Restated from Task 2910, During the site visit on October 2, 2008, Dr. Collins and Joe Helfrich discussed the requirements of R645-302-321.260 and concluded that "an analysis of a series of aerial photographs including infrared imagery flown at a time of year to show any summer and fall differences between upland and valley floor vegetation" had been completed by the applicant (personal conversation with Patrick Collins, 10/2/2008). Although it was not specifically stated during the discussion in the field, the Division came away with the understanding that the results and conclusions of the analysis were readily available in the application and therefore the information in the application partially met the requirements of this section of the regulations. However, a discussion of the results and specific conclusions from the comparative analysis of the color infrared aerial imagery, plates 3 and 4 still needs to be included in section 7.1 page 31 of Appendix 7-7. Although the Applicant utilized the aerial photos in their analysis, a discussion of the

results and specific conclusions from the comparative analysis of the color infrared aerial imagery, Plates 3 and 4 still needs to be included in section 7.1 page 31 of Appendix 7-7. (repeated request from Task 2910) [JH]

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